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NEW-YORK TRIBUNE.

ASTRONOMY.

LECTURE III....BY PROFESSOR MITCHELL.

Reported for The Tribune by Wm. H. Burr, Phonographer.

Adherence to Established Notions of Nature's Laws....Natural Laws the Expression of God's Will....Difficult to Conceive the Object of Creation....Perpetuity a Design....A Simpler System Possible....Perturbations Difficult to Calculate....A Higher Design than Mere Stability....Newton's Calculations—Orbitical Curves—Figure of the Earth—Centrifugal Force resulting from Rotation—Inclined Plane and Centrifugal Force Equal....Other Orbs kept within Limits of Perpetuity....Elliptical Figure of Orbs affect their Motion....The Equinoctial Points—Egyptian Observations—Precession of Equinox—It Results from the Elliptical Figure of the Earth—Explanation of Causes of Precession....Tides—Causes of Tides....Variation of Orbits from Ellipse to Circle—Effects upon the Moon's Motion....Telescopic Appearance of the Moon—Measurement of Hights and Distances in the Moon—Absence of Atmosphere on the Moon, &c.

LADIES AND GENTLEMEN: In the examination of the Structure of the Universe, we are very apt to adopt the idea that it is impossible that any other System than the System which we now know, does or could exist. We go even farther, and conceive the idea that the great Laws which now govern, are the only laws which could govern,—that the Law of Motion, for example, is a necessary Law of Matter, and that the Law of Gravitation is a Principle inherent in Matter, which cannot be severed from it. These are views which are too generally entertained; and in the outset of what I am about to say this evening, I beg to be understood as to my own conceptions with regard to these important points.

I believe that "In the beginning, GOD created the Heavens and the Earth;" that he selected the Laws by which He would govern the Universe, and that these Laws are the perpetual and unchangeable expression of His Almighty Will. But, do you ask the question: Could this system of ours, upon which we look with so deep an interest, have been differently arranged, and yet have accomplished the grand objects which it seems designed to accomplish? That depends entirely upon what we conceive to have been the grand object. I contend it could not have been differently arranged with the objects in view which we have reason to believe were had at the time of its contemplated organization. But do we, on the way through our examination, conceive fully and entirely—or even approximately—the grand object of this scheme by which we are surrounded? I know it is difficult to touch this subject; it is hard to make myself understood: but a very few moments of explanation, I trust, will be sufficient,—and then I will proceed to the application of the Laws of Gravitation.

In the first place, the great design in constituting the System by which we are surrounded and with which we are associated, was to give to it perpetuity, so that it may not have the elements of its own dissolution and decay within itself.

Let us stop here for a moment and see whether this object could have been attained in any other way. I believe that it could have been attained in a much simpler way than it now is. Do not misunderstand me, for I use the expression with all reverence. If the Law of Gravitation had been a little different; if instead of every particle of matter attracting every other particle in the Universe, this law had been announced thus: The Sun shall attract the planets, but they shall not influence each other—the planets shall attract their satellites, but these revolving satellites shall have no attractive influence upon each other—the Sun shall draw the comets from the depths of Space, and shall bring them to itself and throw them off again without their being influenced in any degree by approximation to the planets among which they move,—then we should have a stable system—one that would have endured throughout the ceaseless ages of Eternity itself. And how simple this System would have been in comparison to the one which now exists. In the one by which we are surrounded, we find perturbation upon perturbation, disturbance upon disturbance, causing reaction throughout the whole, till every movement becomes so complicated and involved that it seems almost impossible to understand or follow their devious operations.

On the contrary, had the other System been adopted, so soon as we should have attained to the true position occupied by one of these beautiful orbs in its revolution above us—its uniform movement being fully understood—from century to century, from age to age, as far as the imagination can stretch in point of time, no change, not a solitary deviation ever would have been made from the route which it first pursued.

But there was a higher object to be attained in the Structure of the Universe, than mere stability. We have shown how that might have been done. But this complicated System was given for our instruction, as a grand problem which would lead us in our investigations onward and upward to Him who built the Universe in Wisdom and with Power.—And hence we find the complication by which we are surrounded—and in this complication we find that which stimulates and excites the human intellect to its highest possible attainments.

With this explanation, allow me to refer, for a single moment, to the concluding part of my last Lecture. I attempted to exhibit to you the process of reasoning by which Newton accomplished the demonstration of the Law of Gravitation—to show you how, by the examination of the movements of the Moon in its orbit and the amount of space through which it fell toward the Earth, under the influence of some attractive force there located, he found that force varied according to a certain law, to wit: The Inverse Ratio of the Square of the Distance.

The next point made—after he had attained this first one—by which he became convinced that this law was true, was to extend his examinations onward to see whether, in all other instances, this might be applied with success, and if the movements of the other heavenly bodies could be accounted for on this hypothesis. He therefore commenced the examination of the great problem of which this was to be merely a corollary. He propounded to himself this vast question: Suppose a body to exist in Space, located in such a manner as in a sense to be isolated. Now, as this body is endued with this power of attraction which shall follow in the inverse ratio of the square of the distance: What would be the nature of the curve described by the body revolving about this center, when under the influence of force varying as did the force of gravity?

As I have already related, Kepler had found that the planets described elliptical orbits, having one axis passing through the center longer than all the others, and another axis perpendicular to this shorter than all the others. Inasmuch as they did thus revolve, Newton hoped and believed that when he should have arrived at the truth in the investigation of this problem as to the curve described, that it would prove to be an ellipse, inasmuch as they were known to revolve in these curves. He takes the analysis which he had conjured up for his aid, brings all his intellectual power to bear upon the problem and subjects it to an irresistable analytical reasoning, of which all the data were perfectly within his grasp. The result comes out—in a kind of cabalistic, algebraic characters which I cannot explain to you at this time. But it is sufficient to say, that there was an additional meaning; and the query was, What was that meaning? Was it an expression exhibiting the curve of the ellipse? It was strange, even to Newton, what that expression was; it did not look familiar; it did not exhibit the proportions of this elliptical curve—and what could it be? With much labor he unraveled the mystery, and to his astonishment he found that, instead of being the equation of the ellipse, as it is called, it was the equation—the general expression—of no less than *four curves*: the *circle*, the *ellipse*, the *parabola*, and the *hyperbola* were all in like manner involved; each and every one of these curves being the expression to which he arrived as the result of his examination. But what could be the meaning of all this? He looks out upon the System for an answer; and lo! a comet, coming in from the distance, sweeps round the Sun in a curve called the parabola; another describes the hyperbola; the planets revolve in ellipses, and their satellites describe circles. Here you perceive was a very unlooked for result, and it became evident that either one of these four curves might be described about a body revolving about a center under the influence of the Law of Gravity.

When this result was reached, the next inquiry was this: Is it true now that every particle of matter attracts every other particle according to this law? The examination of this question presented many difficulties. How was it to be resolved? How could he tell whether the force of attraction in the Earth for example, was located in the central point of the globe, or distributed throughout the whole mass, existing equally in every particle of that mass. He commences by examining the figure of the Earth—applies the law upon the hypothesis that every particle did attract every other particle—he finds the Earth revolving upon an axis, and perceives what is produced by the operation of this law upon the earth. If, in the outset, the Earth were created perfectly spherical, he finds, under the influence of the swift rotation upon the axis, it cannot maintain that figure: its form must be changed and another given it in process of time; and he even predicted before the measurement had been made, what it must be, and determined what should be the ratio of the polar and the equatorial diameters of the Earth.

But if the figure of the sphere were changed from the action of these laws, might not the process go on and the globe at length become so entirely changed that the particles of matter at the Equator should fly off, and thus the whole mass be disintegrated and diffused in Space?

Let us look at this for a moment. You are all aware of the fact that the Earth is depressed at the poles and protuberant at the equator—that the mass of matter composing the body of our planet is heaped up, as it were, at the equator, and that the radius of the Earth at that point is 13 miles longer than at the poles. How was this figure obtained, and how comes it that it is not destroyed? I will attempt an explanation:

By the rotation of every revolving body there is a force created called Centrifugal Force. This you see verified every day: not a carriage rolls along the streets but you see particles of dust flying off the revolving wheels. The same force is produced in the mass of the Earth itself. Now suppose we pass from the equator toward the poles. When we reach the poles we find there is no tendency to fly off from that point in consequence of centrifugal force, because there is no velocity of rotation. But as we recede from the axis of rotation, and as the radius becomes greater, the centrifugal force is increased in consequence of the velocity of rotation being accelerated.

Now let us take the fluid particles upon the Earth's surface. What will be the consequence if it remain stationary, or if it move upward toward the equator and downward toward the poles?—for the solution of this question will determine the figure of the Earth under certain limits of calculation. These particles, under the influence of the centrifugal force, have a tendency to fly off in a perpendicular direction, and the force of gravity has a tendency to draw them to the center of the Earth. Under the action of these two forces we find the particle does not remain stationary, but is moving upward along a central line upon the surface of the Earth toward the equator, and thus particle after particle is impelled upward. But how is it possible that this operation should ever cease? I will explain the reason.

When a body rests upon an inclined plane the action of gravity tends to bring it down that plane, and it requires a certain amount of force to heave it upward against the action of gravity. Now, when the particle of matter, under the influence of the combined forces already described, is heaved up and locates itself at the equator, still other particles are heaved up, till the whole figure of the Earth is swelled out; and the next particles to be thrown up will ascend in some sense an inclined plane. Recollect there is here a heaping up of matter—a swelling out—and the great level of the Earth is changed, and the time finally comes when the gravity due to the inclined plane upon which the particle rests is precisely balanced by the force which tends to throw it up; and, this equilibrium once obtained, any farther change in the figure of the Earth forever ceases. (Applause.)

—We now take up the Telescope, and with an inquiring gaze examine the other planets. They, too, are moving upon their axes: But with the same velocity with which the Earth moves? No: They all have different velocities. Are their figures in like manner changing by this rotation? I answer: They are all changing; or, if, not, they still possess a figure of equilibrium heretofore obtained. And we find, moreover, that there are certain narrow limits within which a figure of this character must be circumscribed—that if, the velocity of rotation given to any body should exceed a certain amount, this equilibrium is destroyed, the figure is changed, and even its solid substance disintegrated and broken up. But in all the examinations we have been able to make, we find these narrow limits nicely resolved, and no one of these falling bodies has exceeded the limits of stability and perpetuity.

Having examined the effect of Gravitation, I propose to trace out, for a short time, some of the effects produced by this extraordinary change of figure, if I may call it a change. (I do not know if it ever was different.) It is found that a globe will attract precisely as if the matter belonging to it were compacted at its center; and were all the planets precise spheres, then the Problem of the Solar System would have been merely to ascertain what shall be the relative influence of one of these bodies upon the other, all being regarded as simple material points. But this is not the fact: they are spheroids, flattened at the poles; in consequence of which we find a train of results of a curious and complicated character.

When you look out upon the North Star, you find that object apparently fixed and permanent—and if the idea of fixity has ever entered your minds, you can get no stronger conception of it than that which results from the fixity of this star. "As unchangeable as the North Star" has grown into a proverb. But if you could revisit this Earth 12,000 years hence, and look for your favorite bright and beautiful star—lo! it has changed its position—it has wandered to a distant region of the heavens—it is no longer in that point to which the Earth's axis is directed, or near it; but some other has taken its place. What can be the meaning of this? I answer it depends upon the figure of the Earth, and upon the action of the Sun and Moon upon the protuberant matter girdling the Earth's equator.—Now for the explanation of this curious phenomenon.

If it were possible for us to extend the equator of the Earth till it met the Sphere of the Heavens, then to describe around the heavens a circle of fire that we could discern running all the way around among the fixed stars, we should have the curve called the *Equinoctial* in the heavens. Now if we could trace out the track of the Sun among the fixed stars, we should find another circle, but one not coinciding with the one we have already located,—they would form a certain angle, crossing each other at opposite points. The first of these is the *Equator*, the second the *Ecliptic*; and their intersections at their opposite points are called the Equinoctial Points. These points have been and will be examined with the utmost scrutiny.—The attention of the earliest Astronomer was directed to their position in the heavens; and upon the day in which the Sun, sweeping around in its orbit, crossed this other circle called the equinoctial—on that day it was found that the length of the day and the night was precisely equal. Upon no other day did this occur except on the two occasions, when the Sun was in the act of passing through one or the other of these points. It became, then a matter of the deepest interest to locate this point among the fixed stars. I shall not attempt to point out the manner in which it was accomplished. It was simply with the brazen circles they had made for that purpose, that they accomplished this most desirable object. In Egypt great attention was given to this point, in consequence of the fact that they marked some great events, such as the overflowing of the Nile, by the heliacal rising of a certain bright star. In centuries after, by referring this star to the equinoctial points, the overflowing of the Nile came but the star which always announced it did not come down in the horizon.

What could be the meaning of this? Either one of two conclusions must follow. The star itself had moved, or the equinoctial point to which it was referred was moving; and it was found, by referring all the stars to this point, that it was actually moving in the heavens, going backward as it were, to meet the Sun; and in consequence of this movement, the Sun reached the equinoctial point before it otherwise would. Thus the difference of time in the Sun's arrival at the equinoctial exceeded their computations, obliging them to carry forward the equinoctial points: and hence the term—*Precession of the Equinoxes.*

You may ask what has this to do with the movement of the North Star, or the pole of the Earth. I will explain: The point called the North Pole is that through which the Earth's axis would pass if it were protracted so far as to meet the Celestial Sphere. This imaginary axis of the Earth is as fixed and permanent as if it were a bar of iron driven literally through the Earth, and extending out to the heavens in such a manner that its extremities should rest in sockets and upon it the Earth should revolve. Now follow me: Take hold of this iron axle and heave it up so as to change its position. What is the effect? The equator is always perpendicular to the axis, and if we shift the latter in the slightest degree we will in like degree shift the plane of the equator; and this first circle of light which we have supposed across the heavens—the equinoctial—is ever changed as you change the Earth's axis. And whatever change is exhibited in the position of the equinoctial in like manner will be exhibited in the movement of that point called the Pole of the Heavens. But, in the process of time, we find that the point which the circle of the Sun describes through Space, intersecting the ecliptic, revolves entirely around; and if that be the case, then must the Earth, in like manner, be governed and guided by this movement and revolve entirely around the ecliptic. And such is the fact. No less than 25,800 years are necessary to accomplish this mighty revolution! But it is moving on; and, from the earliest period down to the present time, we find this motion has been subjected absolutely to the Law of Gravitation, and that all this complicated result is a consequence of the figure of the Earth. Had our globe been an exact sphere, no precession of the equinoxes would have been known—no change of position of the pole ever would have been marked; but from century to century it would have held its place—permanent—unchangeable—fixed as the seal of Fate.

But for the explanation of the causes of these changes: The Sun and the Moon exert a constant force of attraction upon the Earth according to their masses and their distance. Were the Earth a perfect sphere, the effect of these forces would be equable and producing no perturbation in the Earth's movements: But the prepondering matter heaped up at the Earth's equator, and standing in a position which brings it at an oblique angle to the forces of the Sun and the Moon produces a disturbance of the rotation and a tendency to draw down the equatorial ring to a coincidence with the plane of the ecliptic. But this force is counterbalanced by the rotary motion of the Earth, and while the equatorial ring endeavors to revolve about an axis in its plane it is also forced toward a revolution around an axis perpendicular to that plane. The result is, it revolves around neither of these axes, but on one which divides the angle between the two; and by this revolution the pole of the Earth is as it were vibrated, and describes a small circle in the heavens. This nutation or vibration of the Earth has the effect of retarding it in its orbit, so that at the end of the year it has not completed its journey around the Sun, and, therefore, does not cross the ecliptic in exactly the same place it did before. The consequence is, the heavens and all the host of stars appear to us to be rolling slowly forward—that the equinox goes forward to meet the Sun—and hence the term *Precession of the Equinoxes.* The fact is, the Earth falls short of her full revolution 52″ 1-10 (fifty-two seconds and one-tenth) in a year; and as there are 3,600 seconds in a degree, and 360 degrees in the great circle of the ecliptic, it follows that 25,868 years must roll round before the equinox will make a complete revolution of ecliptic, producing within that period the longest and shortest day in the year on every day from the 1st of January to the 31st of December. This surprising effect is all produced by the comparatively insignificant superabundance of matter aggregated upon the Earth's equator.

But let us look to another point. We find that Earth is not entirely solid, its surface is covered by a fluid within certain limits, and the inquiry arises whether this fluid is stable?—whether there are fixed bounds beyond which the ocean cannot pass, or whether it may not occur that under the influence of the combined action of the planets, tides may not arise which shall sweep over and submerge the entire surface of the habitable globe? I answer again, there are here provisions which mark the wisdom of Him who built the heavens. If it were possible to take up our ocean and to empty it into the cavity of the planet Saturn no stability would ensue—the ocean would overleap the bounds to which we would attempt to confine it, and rush from one quarter to the other, carrying destruction in its path; but owing to the relations existing between the specific gravity of the Earth and ocean, we find the harmony here complete—and although the action is going on constantly—although the waves are caused to leap up in some sense toward the Moon and the Sun, yet there is a limit beyond which they cannot pass.

There are many who find it exceeding difficult to understand the nature of Tides, and how it is that the Moon and Sun should produce them. The heaving up of the water on the side next to the Sun and Moon, is a matter easily comprehended; but how these bodies should produce a tide on the opposite side is quite mysterious. But let us examine this question and see whether an explanation cannot be had. The cause of tides is the attraction of the Moon upon the mass of water on the Earth's surface drawing it upward toward itself. Now if every particle were equidistant from the Moon, then would the action be the same on every one, and there would be no change of figure; but the truth is the Earth's diameter is a very sensible quantity compared to the Moon's distance. The distance of the Moon is 30 times the diameter of the Earth, hence the water on the side next to the Moon is closer than that on the opposite side, and hence there is a stronger action exerted upon that side nearest the Moon.

But to render the explanation more perfect, let us go back to the position we took some time since with regard to the fact that the Moon was ever following toward the Earth. Now this I attempted to explain, and I hope it was comprehended. You will understand also that the Earth is always falling toward the Moon under the action of precisely the same power. Now if we could see a mass of fluid in the act of falling toward a body, we would observe the attracting body operating more strongly upon the particles next to itself and draw them out away from the rest leaving them behind in their race to the center; hence we see why it is that the waves next to the Moon should be protuberant. But how is it that those on the opposite side are swelled out? Because the Earth being nearer the Moon than the ocean on the opposite side, is drawn away toward the Moon and leaves the ocean behind; hence it is protuberant in both directions. But I do not intend to go into a full exposition of the tides; I must pass on to other matters. This has been a most difficult problem for the Mathematician. The combined action of the Moon and Sun, and their coming in opposite directions, producing extraordinary changes,—then the fact that these are not revolving in the same plane and not at all in the plane of the Earth's equator, causes them to sink on one side and bear up upon the other side. In all the computations of these varying influences, the results have nearly coincided with the actual facts.

I propose in the next place to examine the effect produced upon the Moon's orbit by the disturbing action of the Earth. And here I shall have occasion to reveal to you some extraordinary movements that belong to the whole System by which we are surrounded. There are certain elements, as they are called, which fix and determine the nature of the orbit of any heavenly body, in order to understand which it becomes necessary to explain what these elements are.

In the first place, the elliptic orbit is a certain figure determined by a longer diameter called its *longer axis*, and a shorter called its *shorter axis*.—When their lengths are given the figure of the ellipse can be described. This is the first thing—to get the magnitude of the orbit—but when that is obtained we do not yet know what location it takes with regard to other surrounding objects. In order to fix it in Space we must get the *direction* of this longer line called the longer axis. Now the Sun is always located at the focus, and the distance of the Sun to the extreme longer axis is on one side the shortest and on the other the longest possible distance. Having, then, the position of that line, and having the inclination to the fixed plane, we are enabled to locate the orbit in Space. We have yet to obtain the periodical time, and not only the precise position of the planet in some one known point in its orbit, but the particular date, after which we are enabled to follow its movements in all its wanderings.

When we have accomplished this, the question arises: Are there no subsequent changes? There are changes of a most curious and complicated kind, and which in the outset would seem to destroy absolutely the nature of the orbit, and lead to the ultimate destruction of the entire System. In the Moon's orbit we find that the point nearest to the Earth, called the Moon's perigee, is never fixed and permanent, but always varying its position, and finally performing an entire revolution. This is a point to which Newton directed his mind, attempting to account for the rapidity with which this line was revolving in the heavens upon the hypothesis of Gravitation. He brought into account, as he supposed, every point that could bear upon the result, and when he reached it, he found the amount of change was not coincident with that actually exhibited in Nature. Here the Law of Gravitation seemed at fault; and after many tedious efforts, this great man actually died without solving its mystery. It was taken up afterward by his successors, and in every instance it seemed that Newton's results were confirmed most absolutely. It was finally given up to Clairaut, who grappled it with all the power of analysis; but in spite of all he could do, he reached just the results attained by all his predecessors; and, for a moment, he declared it was impossible to account for this curious exhibition in the heavens. But, strange as it may appear, an individual without education in Astronomy, with simply a knowledge of Mathematics, stepped forth and ventured to defend the Law of Gravitation, and there was a long dispute between the two—one of them a Metaphysical Philosopher, and the other, one who had devoted his best energies to the cultivation of pure Abstract Science. Clairaut determined to prove himself right; reviewed his entire investigation, and finally in the examination of a mathematical series, entering into the result, which at each successive term had grown less and less till it seemed that they were absolutely to disappear, and he believed they would disappear, and that the remaining ones might be neglected; he found, on pursuing the problem a little farther, that the character of the terms began to change, and instead of diminishing they began to increase, so that when he had added together all the terms and completed the result, he found the Law of Gravitation was confirmed in the most absolute manner—Theory and Observation coinciding precisely. (Applause.)

I would call your attention to another single investigation, which has, in like manner, demonstrated not only how far the human mind can carry its researches, but how absolutely applicable this one solitary law is to all the changes and phenomena which are exhibited by these heavenly bodies. I have already told you that we have records of eclipses extending back 2,500 years. Now when we come to examine the velocity with which the Moon was moving at that time, we find that it is not the same with which it is now moving; that it is actually in advance of the position it should occupy—on the hypothesis that its motion is uniform and was accurately determined at that time—by an amount equal to nearly four times its diameter. It seemed impossible to account for this acceleration of motion. Every effort was made to reduce it to the Law of Gravitation; but it seemed to evade every attempt. Some were disposed to reject the early observations; others believed that there was a resisting medium which impeded its motion, diminishing its distance from the Earth, and accelerating its motion around the Earth, describing a spiral line, and that slowly and surely it would at length approach our globe and bring destruction to the whole System.

In this dilemma, La Place comes in to the rescue of Physical Astronomy. He took up this problem, and with the aid of the accuracy he had obtained in his previous investigations, he finds himself able to master it, and not only to do this but to tell the reason why it was that this accelerated motion of the Moon was going on. I will attempt his explanation.

It is found, on examination of the elements of the orbits of the planets, that this longer axis, which been described, is invariable—it never changes—while the shorter axis is subject to fluctuation according to the configurations of the heavenly bodies. It is found that the Earth's orbit is chaning its figure. It is now eliptical; but this is slowly disappearing. It has been going on for centuries and must continue for centuries to come, till finally the shorter axis becomes equal to the longer, the eccentricity of the orbit disappears, and the Earth revolves in a perfect circle around the Sun. When this point shall have been reached, analysis demonstrates the truth that a change begins and the figure then circular, slowly begins to come back again to its elliptical figure; and thus, in periods so great that the human mind cannot stretch sufficiently far to comprehend them, we find these mighty oscillations sweeping backward and forward in the narrow limits within which Infinite Wisdom has confined them.

But what effect should this change have upon the motion of the Moon? I will answer. The Moon is revolving about the Earth, and its motion is impressed upon it. Now, if no other object existed outside the Moon's orbit, the Earth would be able to draw the Moon closer to itself and impress upon it a central movement. But all the other heavenly bodies are on the outside of the Moon's orbit drawing it away from the Earth, taking it partly from under the influence of the Earth and [illegible] possible to remove the Earth and the Moon farther from these disturbing influences, then will the Moon come entirely under the influence of the Earth, and its motion will be increased. Now this is the exact case in Nature: it is precisely what is going on, in consequence of the changes on the figure of the Earth's orbit. Its orbit is becoming more nearly a circle, not bringing the Moon so near the Sun as it once did; hence it is able now more effectually to master its own satellite and thus impress upon it a more circular orbit.

But is this to go on throughout Eternity? I answer, no. For when an orbit shall have attained a circular form and begins to recede back to an elliptic figure, then will these changes again take place in the motion of the Moon, and that which was once acceleration become retardation and from the effect of the very same cause, the Sun will begin to take hold of the Moon with greater and still greater power. Now what the period of these changes may be—although possibly within the limits of calculation—we have not yet computed. One thing, however, we do know—they are not to be reckoned by hundreds or by thousands—they must expand to millions of years before the exact conformation of the System can be brought about again.

Though I have presented you demonstration upon demonstration to night, you will pardon me if I occupy a little more than my allotted time in giving you some account of the Telescopic Appearance of the Moon's Surface. Those who for the first time behold the Moon's surface through a powerful instrument, will always be disappointed in its appearance. There are mighty mountains on its surface; there are deep bleak cavities, some perhaps fifteen, twenty, forty and even sixty miles in diameter and sinking below the surface seven and eight thousand feet. Out of these, mighty rocks arise two thousand feet above the level of the valley, casting their deep black shadows upon the plains below. All these things are very fine; and yet on looking at them through the telescope for the first time, one is invariably disappointed. You cannot see mountains as you see them in the Highlands of New-York. You cannot see the gray rocks projecting so beautifully as you behold them on some earthly mountain hight. Remember after your telescope has carried you out as far as it can reach, there is yet a whole hundred miles to be overcome. So in spite of all you can do, and with all the aid you can bring, you are a hundred miles from the object.

But do we know nothing of the Moon? Are we so far off that we can tell nothing of the characteristics of its surface? I answer: We know that towering mountains lift their lofty heads, deep caverns yawn, and there are vast circular elevations resembling the usual productions of volcanic action. And how do we determine these things?—By the lights and shadows which show themselves to the eye we measure the hight of these mountains, by remarking the relative position of the Sun and the Earth. We mark the extremities of their long deep shadows and find that as the Sun slowly rises the shadows by degrees recede toward the base of the mountains; and when noonday arrives they entirely disappear. Then as the Sun begins to decline on the other side, the same dark shadows are cast in the opposite directions. We watch these movements till we ascertain with perfect certainty the character of the object which casts the shadow, and we measure its hight. These are reliable facts.

But the question next comes: How is it possible to measure the depths of those deep cavities? It appears as if immense lakes had once filled them, and by some extraordinary means the water had been evaporated, leaving the interior dry, hard and sterile. We find these depths in like manner as we ascertain the hight of mountains. When the Sun is first rising it casts its light into these cavities of the Moon; we see shadows cast by the sunward sides, and the limits of the cavities are defined with a degree of accuracy surpassing anything upon the surface of the Earth. For the shadows are not here so black as upon yonder orb.—They are mitigated and dispersed through the influence of our atmosphere. But on the Moon there is no atmosphere, at least not such a one as will compare at all with ours. The Moon's atmosphere, if indeed it have one, can be no denser than the extremely rarified air left in the most perfect vacuum yet produced in an exhausted receiver. It cannot sustain animal life—it cannot support clouds nor can it sustain combustion. And, for the reason that the Moon has no atmosphere, there is no gradual fading away of the light as the Sun sinks deeper below the horizon—no soft, mild and lovely twilight, such as sheds a holy serenity over our favored globe—but instantaneous and appalling darkness follows the setting of the Sun, drear as the night of Death; and broken—not by the "rosy fingered morn," slowly waxing from faint streaks of light to the fullness of the day-spring—but startled from the very depth of blackness by the lightning-flash of the Sun's meridian glory. (Applause.)

Death of Chancellor Kent.

Upon the assembling of the Supreme Court yesterday, the venerable SYLVANUS MILLER, in a few pertinent and pathetic remarks, announced the decease of this distinguished Jurist. Tears accompanied the announcement, and the scene was one of truly painful interest. The motion to adjourn the Court, seconded by Chancellor LORD, till to-day at 11 o'clock, was responded to by Chief Justice OAKLEY, and the Court was adjourned accordingly. The Bar will meet in the Hall at 10 o'clock this morning, with a view to adopt such measures as may be thought appropriate on the occasion, and expressive of their high appreciation of the eminent talents of the individual whose death they are suddenly called upon to mourn. Chancellor KENT was in his 85th year.

THINGS IN WASHINGTON.

From our own Correspondent.

WASHINGTON, Sunday, Dec. 12.

Something about Mr. Walker—Appointment of Committees—Mr. Holmes of S. C.—Preaching of Bishop Hughes.

It may be that my letter in regard to Mr. Secretary WALKER's sickness has been misunderstood. I certainly intended the expression of no indifference respecting his health, but merely to criticise with some animadversion the article in the *Union* descriptive of his immense labor and its unfortunate result. Mr. WALKER is an amiable man in private life, and political opponents, no less than friends, would regret his serious indisposition. I am very happy to announce his decided convalescence.

I may have been too hasty also in pronouncing an opinion of his Report. A more careful perusal has discovered ability and indication of much native talent, unrecognized on a hasty perusal. His logic is ingenious, and upon many minds might be conclusive. He certainly has labored hard to make "the worse appear the better reason," and with no indifferent success. Still to compare this production of his mind and pen with the emanations of HAMILTON, of GALLATIN or SPENCER, is gross adulation and can be only intended as such.

To expose the disingenuousness of the President's Message and the specious sophistry of the Treasury Report, will be the successful effort, undoubtedly, on the floor of the House of some leading Whig.—Who is to undertake the ungrateful and yet necessary task, I have not yet learnt. It was at one time supposed that Mr. ASHMUN, who is eminently qualified for the duty, would have assumed its discharge—but engagements in the Supreme Court, which he can neither avoid nor postpone, will prevent, it is feared, his undertaking the office. There are many others, fortunately, both of the new Members and the old, abundantly able to execute the task. It can be, and will be, done—and done well.

You will receive by Telegraph in the early morning the constitution of the Committees. Mr. WINTHROP has given to this delicate, and oftentimes invidious, duty his earnest and patient attention. Nor can it be doubted that he will give general satisfaction, notwithstanding the peculiarly embarrassing position in which he is placed—with a House not only equally divided (or nearly so) between the two great belligerent parties of the country, but also presenting differences of various character among the members themselves of each political party.

The subdivision of the Committee on Commerce into Foreign and Domestic, will afford Mr. WINTHROP an opportunity, of which it is not to be doubted he will avail himself, of doing justice to an eminent opponent, while he withholds none from an equally deserving friend. At least it is generally credited that while Mr. GRINNELL of Mass. will assume the appropriate function of Chairman of the Committee on Domestic Commerce, to Mr. HOLMES of S. C. will be tendered the equally important, and I may add, equally merited position of Chairman of the Foreign. He is a man of enlarged ideas, who looks beyond the horizon of his own State and studies deeply the interest of the whole country. A man safe in council, of earnest endeavor, and energetic in action [illegible] at the same time a man of full and profound theories, looking farther than a servile imitation of the past, and not perplexed to act, when the file ceases to afford its precedent. He is beside equally respected by both parties.

The day has been one continuous rain, and borne a dull and gloomy aspect. But the unpropitious weather has been impotent to prevent the full crowding of the Hall of the House of Representatives to hear Bishop HUGHES. Pennsylvania-avenue was thronged during the morning with vehicular and pedestrian passengers, wending their way to the Capitol; and long before the hour appointed for the commencement of services, the vast Hall was deeply filled, floor, galleries and lobbies, with an expectant multitude. I will not undertake an impossibility—and therefore refrain from even an attempt to convey an adequate idea of the merits of the production. It requires no other encomium than its parentage. It was worthy of one of the most eminent divines of this or any country, and it is a source of infinite satisfaction to know that it will be published *verbatim*. M.

By Telegraph to The Tribune.

New-York Legislature....SPECIAL SESSION.

MORNING REPORT.

SENATE....MONDAY, Dec. 13—1 M.

The bill to repeal the law to Equalize Taxation (an Anti Rent measure) was referred to the Finance Committee.

The bill to Consolidate Deposit and Common School Funds, and the Reduction of the number of Loan Commissioners was recommitted, so as to make the Counties responsible for loss of moneys under said loans. The bill was subsequently reported and ordered to a third reading.

Mr. SANDFORD reported a bill to permit the Trustees of Savings Banks to make temporary deposits in Free Banks.

ASSEMBLY.

A memorial of the Board of Health against the bill amending act in relation to Commissioners of Emigration was presented.

Mr. T. SMITH reported for the consideration of the House a bill to Reduce the Fees of County Clerks.

Mr. CROSBY reported against incorporating the American and Foreign Bible Society.

Mr. PERKINS reported County Clerks' bill complete, so as to take effect on Clerks in office on January 1, 1849, except the Clerk of the County of New-York.

Mr. SICKLES moved to recommit with instructions to strike out section excepting the City of New-York. Agreed to, 44 to 25.